Simulation Analysis of Web Application

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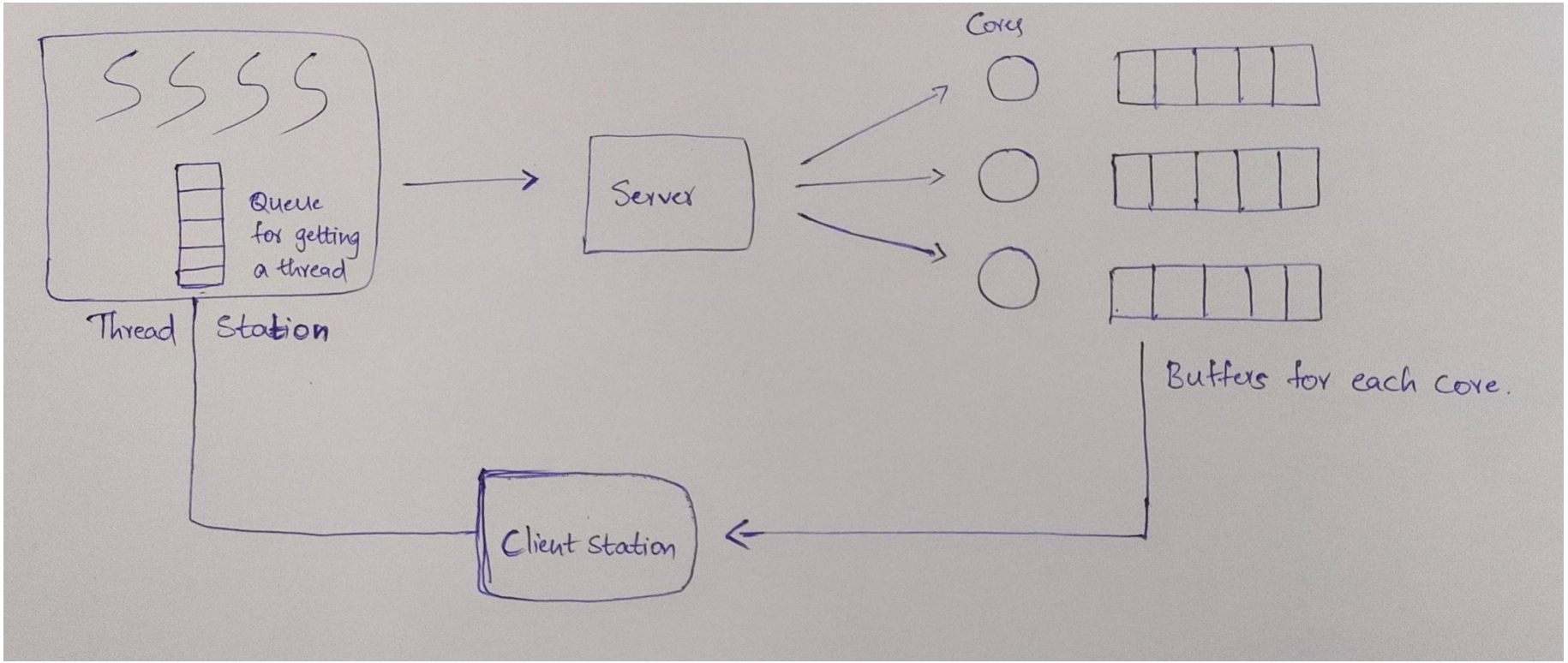
System Assumptions

- Number of threads are limited
- Each core has a buffer, buffer has a buffer list which tells us which threads are currently in the buffer.
- Think time, service time, request timeout can be uniformly distributed, constant or exponentially distributed.
- All the requests are stored in a request queue, which is of finite size.
- Requests get dropped if the queue is full
- Event list is similar to priority queue. We pick the most imminent event from the event list and process them.

Modelling of The System



Configuration

No of Cores = 2

No of Users = [50,1000] range

Service Time = 2ms (Mean of Exponential Distribution)

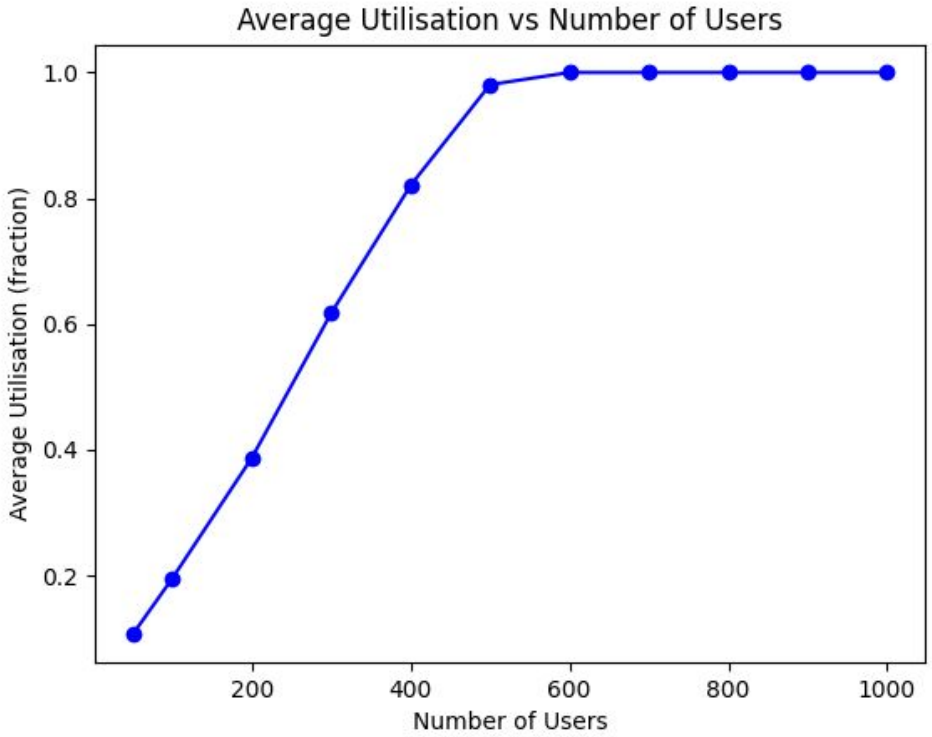
Think time = 500ms (Mean of Exponential Distribution)

Saturation Number (Maximum Load) = 1 + (ThinkTime * No of cores / ServiceTime)

= 1 + (500*2/2) = 501

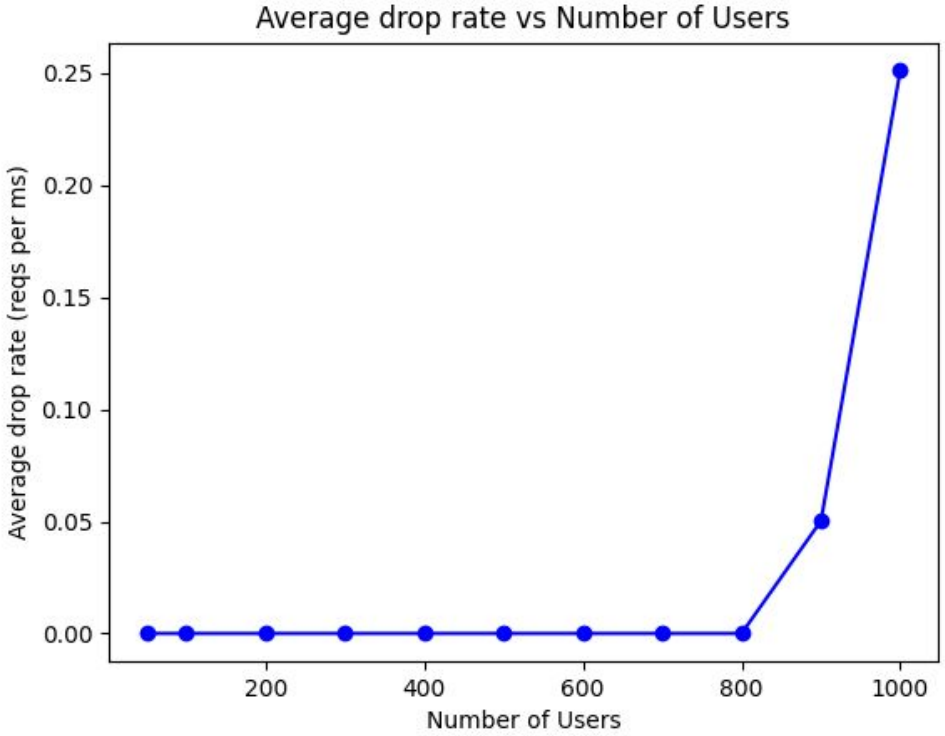
Note : As per the configuration we expect to see the utilization 1 when the no of users are 501.

Average Utilization vs Number of Users



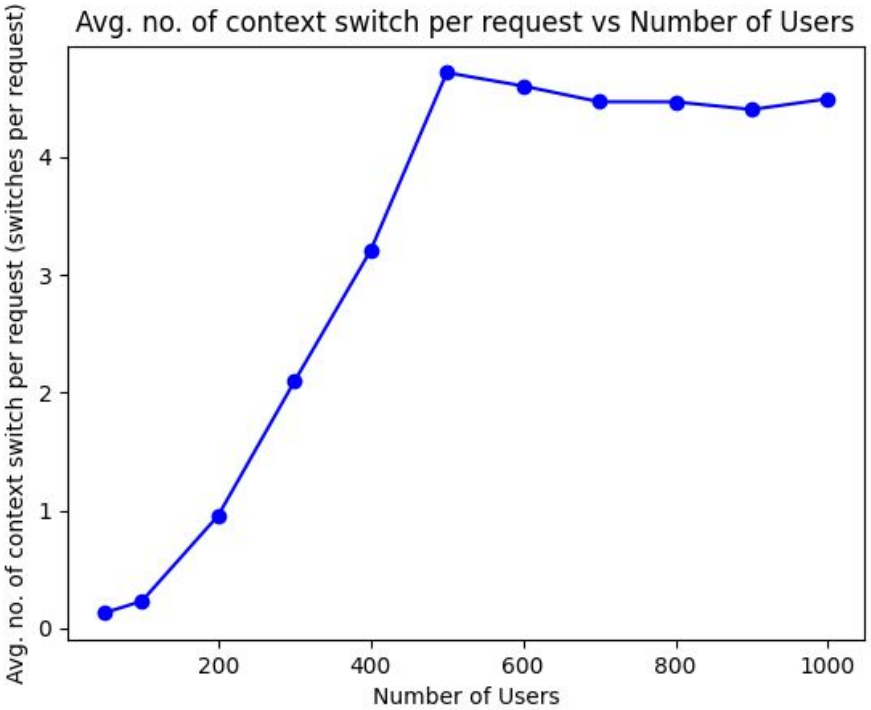
- As expected we can see the utilization reaching 1 near 501 users.
- Average utilization increases and then saturates to 1 as the number of users increase.

Average Drop Rate vs Number of Users



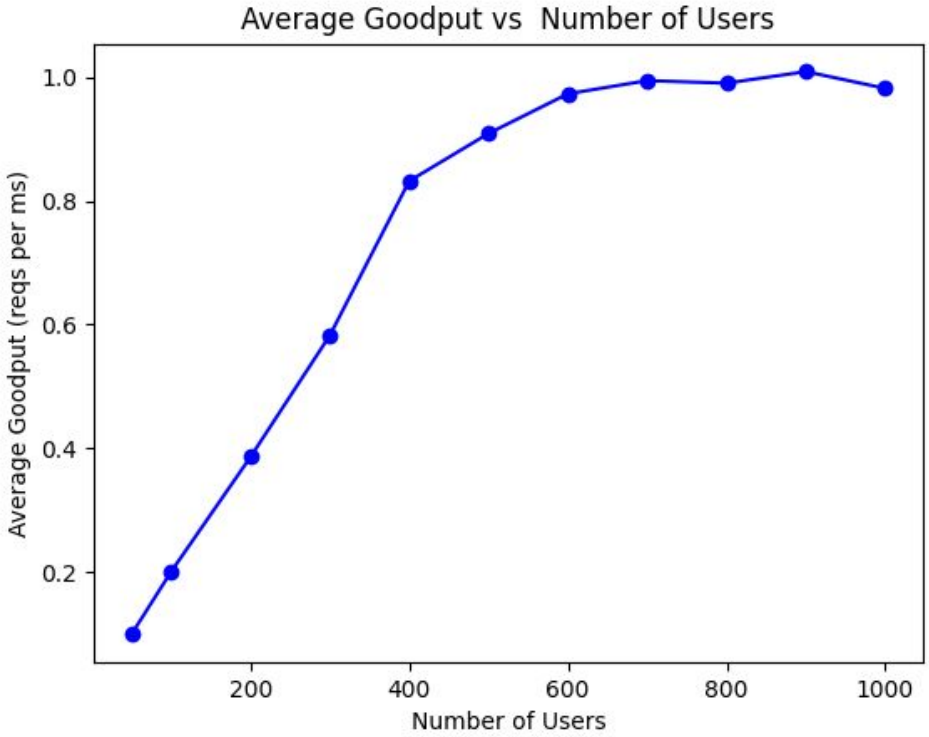
- The average drop rate increases with the number of users. When the load is low, very less number of drops occurs (almost 0), but as the users increase, more and more requests are being dropped.

Avg No. of Context Switches vs Number of Users



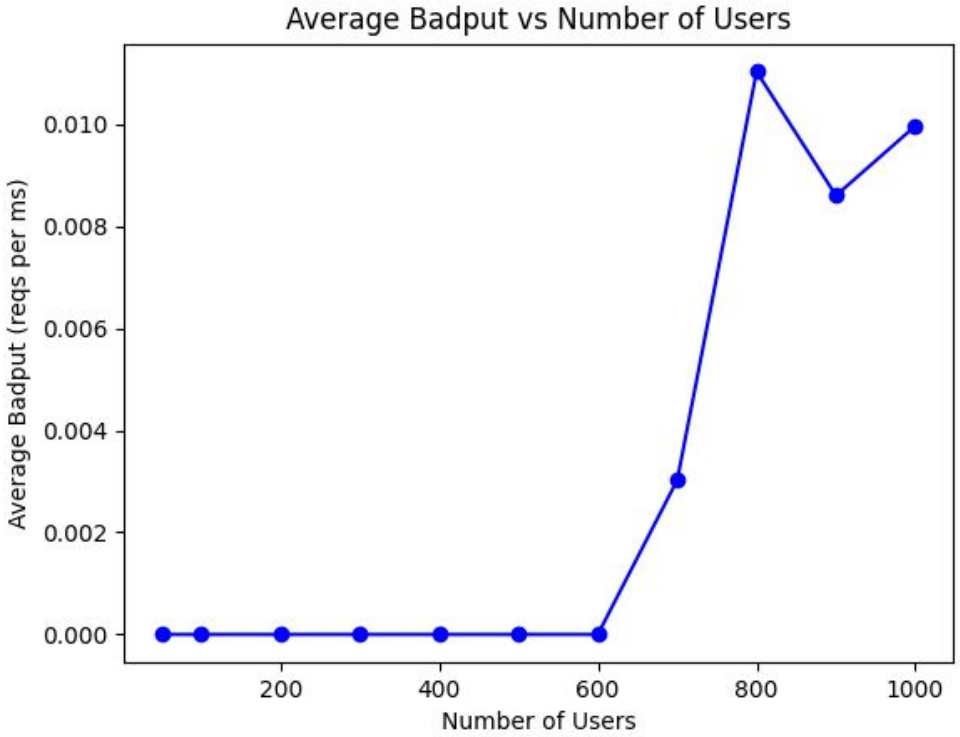
- This also increases and then saturates as the number of users increases. Initially, when load is low, less number of context switches happen. When it is high, it saturates because the number of threads are fixed.

Average Goodput vs Number of Users



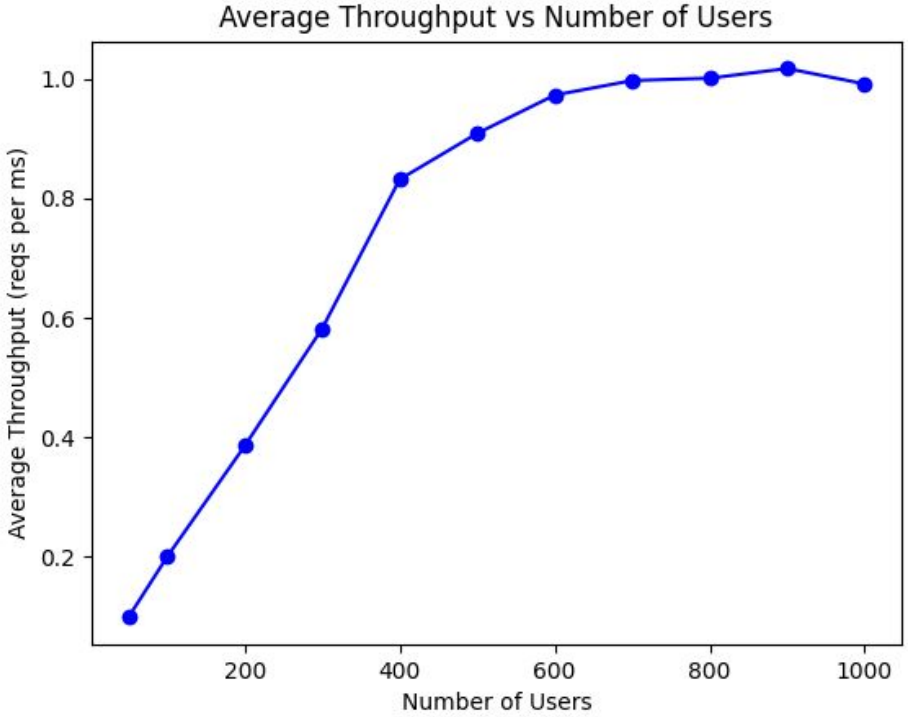
- Average Goodput increases with the number of users.

Average Badput vs Number of Users



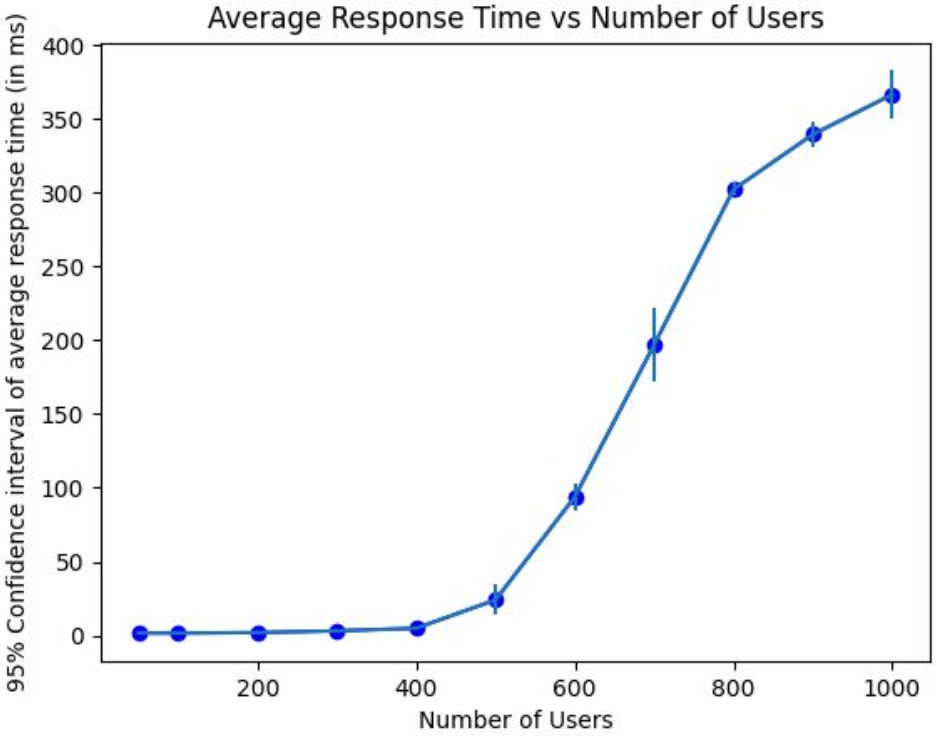
- Average badput also increases with the number of users. When the load is low, timeouts are very less, so badput is also less. However, when the load increases, the chance of timeout also increases, indicating a higher badput.

Average Throughput vs Number of Users



- Average throughput increases and then saturates as the number of users increases
- This is as expected

Average Response Time vs Number of Users



- Response time increases slowly at the beginning and after the max load that is 501 users response time increases rapidly.
- This is as expected.